20/5/2010

Realization of one port network using RC and RL

LC

2 Condition of LC:

$$\frac{N(S)}{D(S)} = \frac{\text{odd}}{\text{even}} \quad \text{or} \quad \frac{\text{even}}{\text{odd}}$$

$$|\text{degree of } N(s) - \text{degree of } D(s)|$$

RC

$$Z(s) = \frac{N(s)}{D(s)} \quad \text{or} \quad Y(s) = \frac{N(s)}{D(s)}$$

$$\boxed{\frac{N(s)}{D(s)} = \frac{\text{odd} + \text{even}}{\text{odd} + \text{even}}} < \begin{matrix} RC \\ \text{or} \\ RL \end{matrix}$$

$$\boxed{\begin{matrix} Z(0) \geq Z(\infty) \\ Y(0) \leq Y(\infty) \end{matrix}} \rightarrow RC$$

RL

$$Z(s) = \frac{N(s)}{D(s)} \quad \text{or} \quad Y(s) = \frac{N(s)}{D(s)}$$

$$\frac{N(s)}{D(s)} = \frac{\text{odd} + \text{even}}{\text{odd} + \text{even}}$$

$$\boxed{\begin{matrix} Z(0) \leq Z(\infty) \\ Y(0) \geq Y(\infty) \end{matrix}} \rightarrow RL$$

لازم نتأكد من حل بيانيا

EX 1: Realize using cauer I

$$Z(s) = \frac{3s^2+18s+24}{s^2+3s}$$

Sol:-

$$Z(s) = \frac{3s^2+18s+24}{s^2+3s}$$

$s^2+3s \,\big|\, 3s^2+18s+24$

$\boxed{3}$ ← $Z_1 = R_1$, $R_1 = 3\Omega$

$\quad -3s^2 - 9s$

$\quad 9s+24 \,\big|\, s^2+3s$

$\boxed{\frac{1}{9}s}$ ← $y_2 = \frac{1}{9}s$, $C_2 = \frac{1}{9}F$

$\quad -s^2 - \frac{24}{9}s$

$\quad \frac{1}{3}s \,\big|\, 9s+24$

$\boxed{27}$ ← $Z_3 = R_3$, $R_3 = 27$

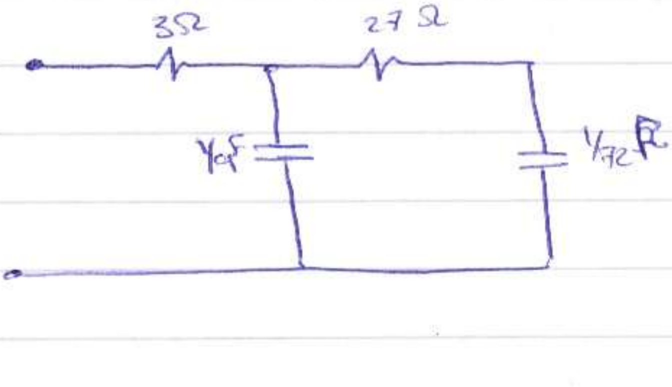
$\quad -9s$

$\quad 24 \,\big|\, \frac{1}{3}s$

$\boxed{\frac{1}{72}s}$ ← $y_4 = sC_4$, $C_4 = \frac{1}{72}F$

$\quad \frac{1}{3}s$

$\quad 0$



[illegible]

Ex2: Realize using Cauer II

$$y(s) = \frac{3s^2+18s+24}{s^2+3s} = \frac{24+18s+3s^2}{3s+s^2}$$

$3s+s^2 \,\big|\, 24+18s+3s^2$

$y_1 = \frac{8}{s} \leftarrow \boxed{\frac{8}{s}}$ $\quad$ $\underline{24 + 8s}$

$L_1 = \frac{1}{8} H$ $\quad$ $10s+3s^2 \,\big|\, 3s+s^2$

$Z_2 = R_2 \leftarrow \boxed{\frac{3}{10}}$ $\quad$ $\underline{3s + \frac{9}{10}s^2}$

$R_2 = \frac{3}{10}\ \Omega$ $\quad$ $\frac{1}{10}s^2 \,\big|\, 10s+3s^2$

$y_3 = \frac{1}{sL_3} \leftarrow \boxed{\frac{100}{s}}$ $\quad$ $\underline{10s}$

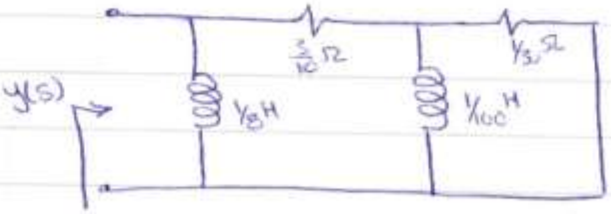
$L_3 = \frac{1}{100} H$ $\quad$ $3s^2 \,\big|\, \frac{1}{10}s^2$

$\leftarrow \boxed{\frac{1}{30}}$ $\quad$ $\underline{\frac{1}{10}s^2}$

0

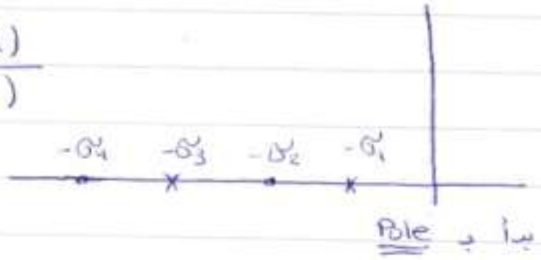
$Z_4 = \frac{1}{30} = R_4$

$\Rightarrow R_4 = \frac{1}{30}\ \Omega$



Properties of Z_{RC} or Y_{RL}

$$Z(s) = \frac{H(s+\sigma_2')(s+\sigma_4')}{(s+\sigma_1')(s+\sigma_3')}$$



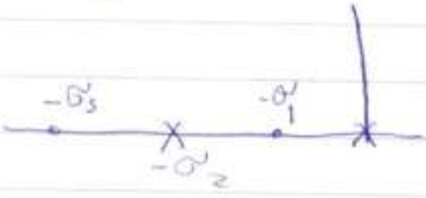
(1) The poles and zero are Simple and are located in -ve Real axis an alternate.

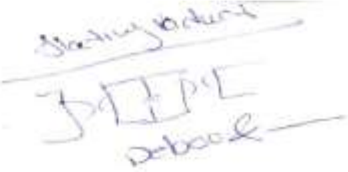
[illegible]

Pole Zero, Pole

(2) It starts with a pole. (may be at origin)

$$Z(s) = \frac{H(s+\sigma_1')(s+\sigma_3')}{s(s+\sigma_2')}$$





Realizing لازم نرسم الدائرة في الـ

حفظ الدوائر

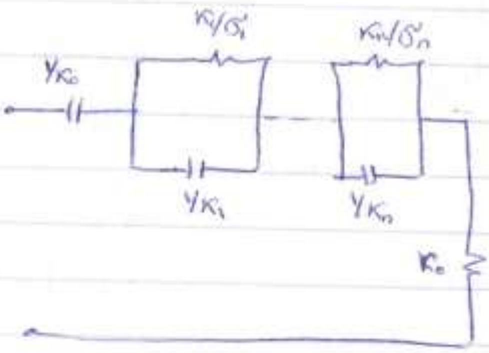
Foster I

$$\boxed{Z(S) = \frac{K_0}{S} + \sum_{i=1}^{n} \frac{K_i}{S+\sigma_i'} + K_\infty}$$ مهم

$K_0 = \lim_{S \to 0} S\,Z(S)$

$K_\infty = \lim_{S \to \infty} Z(S)$

$K_i = \lim_{S \to -\sigma_i'} (S+\sigma_i')\,Z(S)$



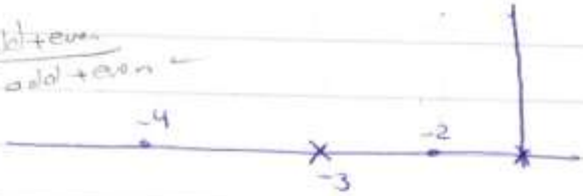
Example (5):-

Realize using foster I

$$Z(S) = \frac{3(S+2)(S+4)}{S(S+3)}$$

sol:-

$$Z(S) = \frac{3S^2+18S+24}{S^2+3S}$$ $\frac{\text{odd}+\text{even}}{\text{odd}+\text{even}}$ ←



$Z_0 = \infty$ $\quad Z_\infty = 3$

$Z(0) > Z(\infty) \Rightarrow$ RC

$$Z(S) = \frac{K_0}{S} + \frac{K_1}{S+3} + K_\infty$$

$K_0 = \lim_{S \to 0} S\,Z(S) = 8$

$K_\infty = \lim_{S \to \infty} Z(S) = 3$

$K_1 = \lim_{S \to -3} (S+3)\,Z(S) = \underline{1}$ لازم يطلع يكون +ve

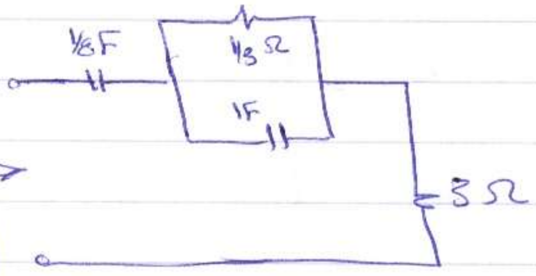
$$Z(s) = \frac{8}{s} + \frac{1}{s+3} + 3$$

$$= \frac{1}{sC_1} + \frac{1}{y_{2a} + y_{2b}} + R_3$$

$$= 1/sC_1 + \frac{1}{sC_3 + 1/R_2} + R_3$$

$C_1 = 1/8\,F$ $\quad$ $C_3 = 1F$

$R_3 = 3\,\Omega$ $\quad$ $R_2 = 1/3\,\Omega$


1/8F
1/3 Ω
1F
3 Ω
Z(s)

Foster II

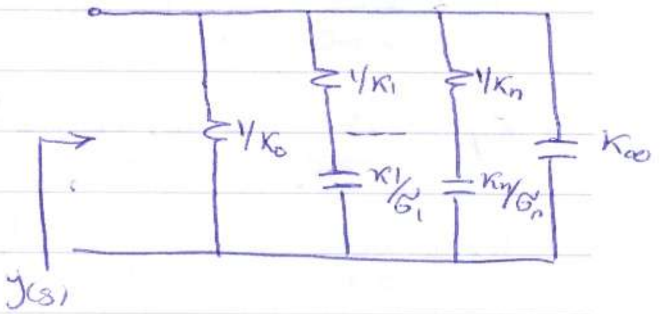
- It Deals with only y(s)
- It provides parallel network

$$\boxed{y(s) = \frac{K_0}{s} + \sum_{i=1}^{N} \frac{K_i}{(s+\sigma_i)} + K_\infty}$$

$$K_0 = \lim_{s\to 0} s\,y(s)$$

$$K_\infty = \lim_{s\to\infty} y(s)$$

$$K_i = \lim_{s\to -\sigma_i} (s+\sigma_i)\,y(s)$$


1/K₀
1/K₁
1/Kₙ
K₁/σ₁
Kₙ/σₙ
K∞
y(s)

مهم بيجي كالامتحان-

Ex (4) : realize using foster II

$$y(s) = \frac{(s+1)(s+4)}{4(s+2)(s+5)}$$

Sol:

$$y(s) = \frac{K_0}{s} + \frac{K_1}{s+2} + \frac{K_2}{s+5} + K_\infty$$

$$K_0 = \lim_{s\to 0} s\,y(s) = 0$$

$$K_\infty = \lim_{s\to\infty} y(s) = 1/4$$

$\frac{-1(2)}{(4)(3)} =$

$$K_1 = \lim_{s\to -2} (s+2)\,y(s) = -1/6$$

$\frac{(-4)(-1)}{4(-3)}$

$$K_2 = \lim_{s\to -5} (s+5)\,y(s) = -1/3$$

اول لما الاقى K_1 و K_2 طلعوا ب $\underline{\underline{-ve}}$

نقسم الحل $y'(s) = \frac{y(s)}{s}$

$$y'(s) = \frac{y(s)}{s}$$

$$y'(s) = \frac{(s+1)(s+4)}{4s(s+2)(s+5)}$$

$\frac{4}{4(2)(5)}$

$$K_0 = \lim_{s\to 0} s\,y'(s) = 1/10$$

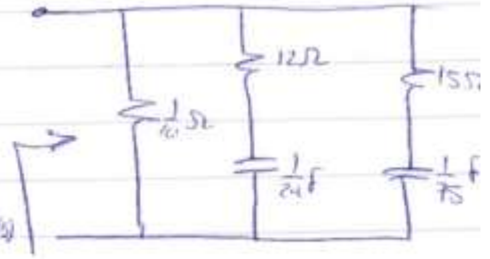
$\frac{(-1)(2)}{(-8)(5)}$

$$K_\phi = \lim_{s\to -2} (s+2)\,y'(s) = 1/12$$

4

$\frac{(-4)(-1)}{15(-3)}$

$$K_2 = \lim_{s\to -5} (s+5)\,y'(s) = 1/15$$



$$y(s) = s\,y'(s)$$

$$y(s) = \frac{1\cancel{s}}{10\cancel{s}} + 0 + \frac{1/12\; s}{s+2} + \frac{1/15\; s}{s+5}$$

$$= \frac{1}{10} + \frac{1}{12 + \frac{1}{s}} + \frac{1}{15 + \frac{1}{5/}}$$

× Realize using Foster I

$$Z(s) = \frac{2(s+1)(s+3)}{(s+2)(s+6)} \Rightarrow RL$$

× Realize using caure II

$$Z(s) = \frac{2s^2+8s+6}{s^2+8s+12} \Rightarrow \underline{\underline{RL}}$$

3 hours → 5 Question
or 6 Question

ركز ع 4,5,6&7

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- Realize using foster I

$$Z(s) = \frac{2(s+1)(s+3)}{(s+2)(s+6)} \Rightarrow RL$$

- Realize using caure II

$$Z(s) = \frac{2s^2+8s+6}{s^2+8s+12} \Rightarrow \underline{\underline{RL}}$$

⊛ 3 hours → 5 Question
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